Institute of
Technical Thermodynamics

PEM Electrolysis: Research on Cost Reduction and System Durability

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Motivation

Hydrogen can be used as a storage medium for renewables. PEM electrolysis is the platform for large scale H_2 production from surplus electricity thanks to its rapid response under dynamic operation and high specific energy density

Objectives

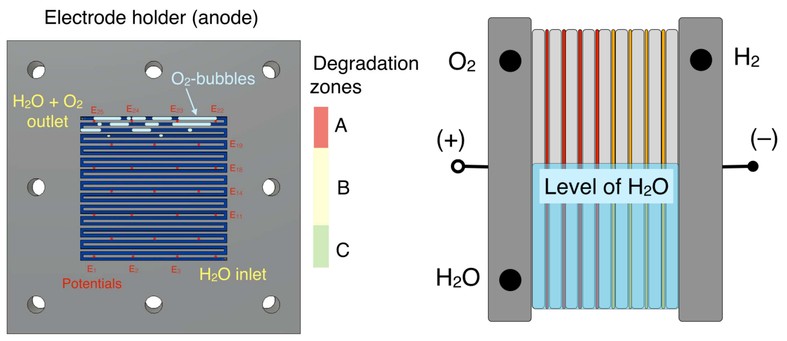
1. Reduce overall cost by optimisation of system and stack components
2. Formulate degradation mechanism and increase lifetime
3. Extend operation dynamic range without compromising efficiency

System

Degradation analysis with segmented cell and test units systems

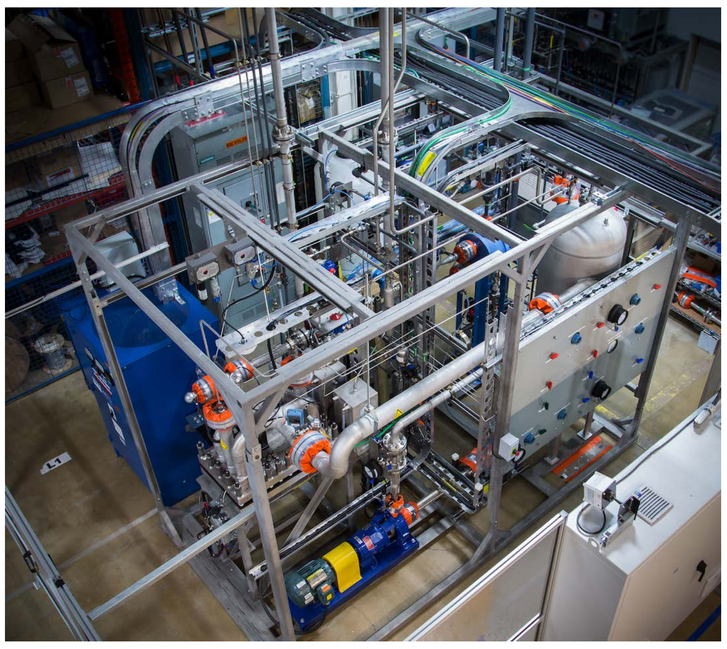
20 kW_{el} test station

Local degradation under wet-dry (gas bubble) cycling

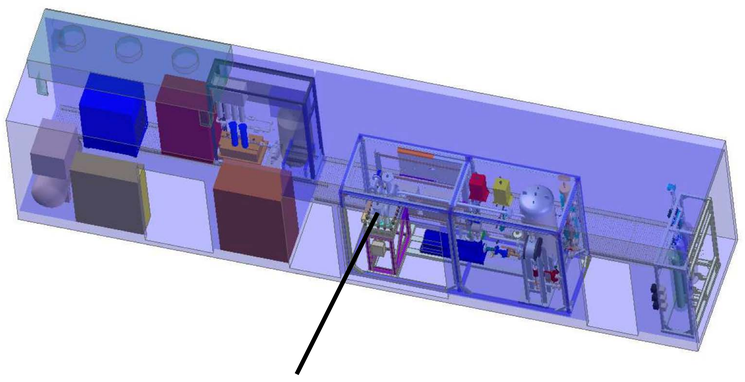


Experiments on partial water filling for studying local degradation effects at the electrode-electrolyte interface

25-50 kW_{el} test station



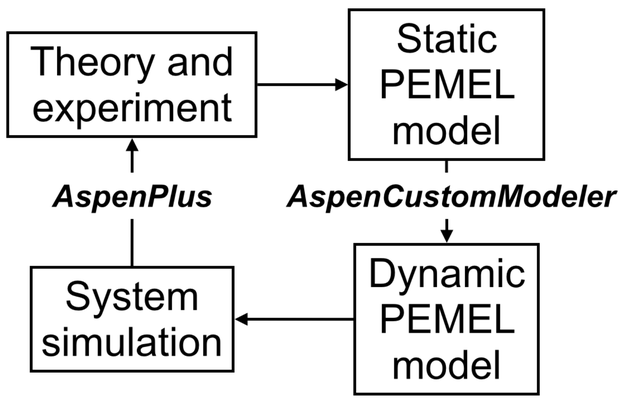
Electrolyser container for gas station in Stuttgart (expected mid 2014)

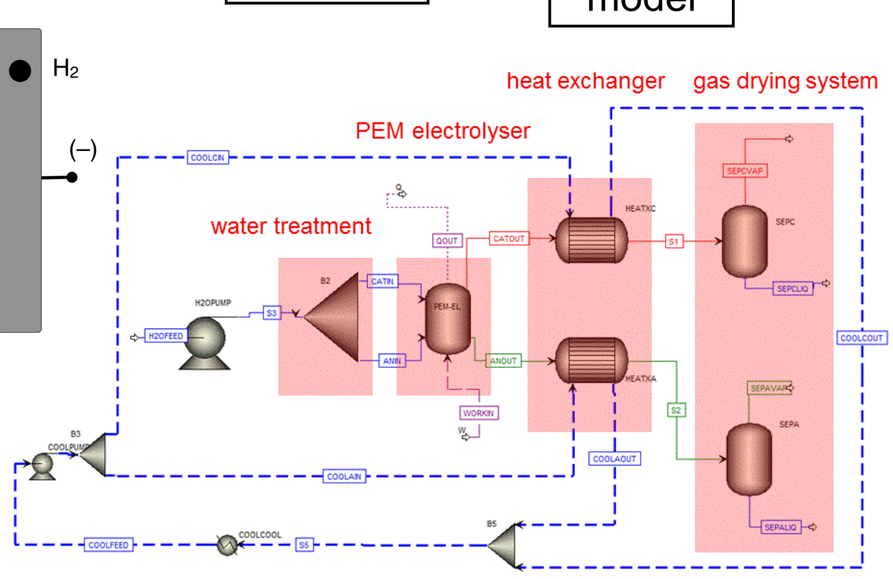


25-50 kW_{el} PEM electrolyser

System modelling

Assessment of degradation issues through modelling

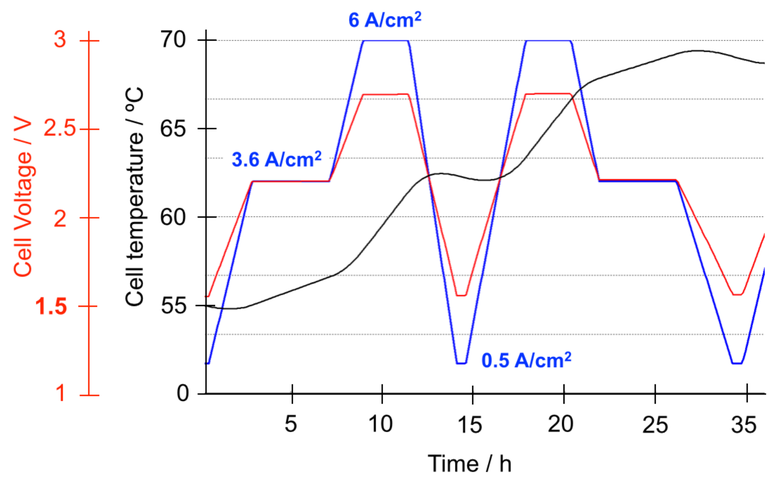




Dynamic modelling

An accelerated stress test (AST) protocol has been conceived based on wind energy input

$$E(T,P) \rightarrow E(T,p,t)$$



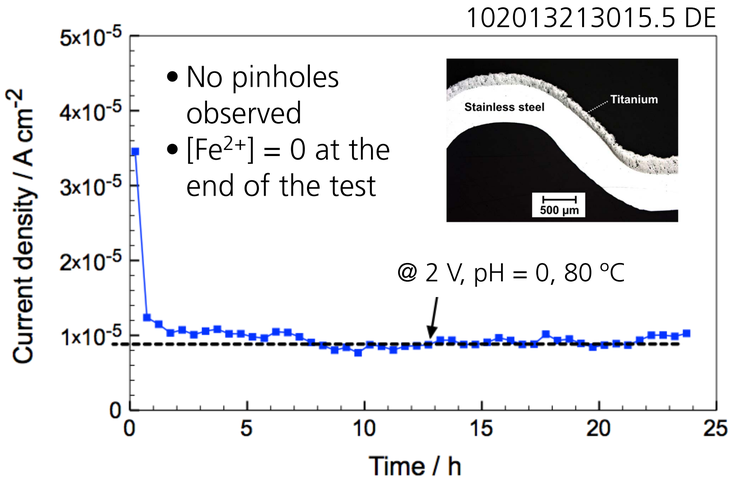
Corrosion protection

Dense coatings of titanium or low cost electro-ceramics for corrosion protection of stainless steel bipolar plates

Vacuum plasma spraying chamber

The developed coating of Ti protects the substrate from corrosion

Patent pending
102013213015.5 DE



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